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EMO

NATIONAL DIGEST

Public Information Lessons

EMO Shelter Programmes

Damage Assessment

The Veterinary Profession In CD

Heating and Ventilating Fallout Shelters

EMERGENCY MEASURES ORGANIZATION

THE EMO NATIONAL DIGEST

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ROGER DUHAMEL, F.R.S.C.
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PUBLIC INFORMATION LESSONS OF CARLA AND REDRAMP

The following article was prepared by Lt Col J. D. Donoghue, Public Information Officer with the federal Emergency Measures Organization.

HURRICANE CARLA, which struck Texas and Louisiana in September, 1961, has been described as the greatest hurricane in U.S. coastal history. CARLA is said to have packed the power of an estimated several hundred nuclear devices and triggered a test of evacuation capabilities far greater than any civil defence exercise had ever achieved.

In the Spring of 1950, Manitoba's Red River went on its worst rampage in 126 years and Operation REDRAMP was born.

Although these two natural disasters took place 11 years apart, in two different countries but on the same continent, the official report of each describes both failure and success in dealing with information problems. The public information aspects of CARLA and REDRAMP are worthy of study by all officers, civilian and military, who have emergency measures (national survival) planning responsibilities or who will be assigned to official duties in a crisis.

The aim of this article, therefore, is to outline some of the important public information lessons of CARLA and REDRAMP and to stimulate interest in the solution of the information problems which will arise in a natural disaster and the man-made disaster of war.

The two disasters had common information problems, solutions and lessons. But no attempt should be made to draw a comparison between the two, either from the official reports or this article, of the relative scale of success attained in dealing with the information problems. The reasons are these: the nature of CARLA with its much larger territory, population and number of communities affected, produced many more information problems of a scale and complexity greater than that experienced in REDRAMP; this article does not discuss all the incidents available. What follows are excerpts from the reports, the lessons illustrated, and comment on those lessons.

"We had (reporters and broadcasters from) Houston, Chicago, Columbia Broadcasting System, TV, everything! They all wanted to interview people. We tried to help them but some of our people hadn't slept for so long they couldn't do much. We allowed pictures." This statement, reflecting a departmental officer's surprise, frustration and weariness resulting from efforts to deal with information problems, is taken from the Hurricane CARLA report.

In contrast is this statement: "In Lake Charles, the civil defense information service was headed by a newsman. A 'hot line' ran to all news media in the city. Releases were given to all at once. The system was universally praised." In the U.S. County of Calhoun and Vermilion Parish, the editors of the local newspapers were the civil defense public information officers. The Calhoun civil defense director commented: "The editor of the Fort Lavaca paper stayed and did a very factual report. We let him deal with the press. After our experience in the previous flood, we set aside our assembly room for the press and put the local newspaper editor in charge to see that their needs were met. He had worked with us so long he knew CD as well as we did."

But another U.S. county CD director reported nothing but trouble. "Emergency public information was a terrific problem," he wrote. "Everyone from New York, Chicago, and Houston was trying to get the story, flocking all over the place. They would go to see anybody—they didn't care. The whole thing was about as confused as it could possibly be."

The following statement is from the REDRAMP report: "A very important aspect of our work was our relations with the public. It was necessary to have their confidence and support. We gave it (public relations) every consideration and it paid off!"

When Premier Douglas L. Campbell of Manitoba requested that Brigadier R. E. A. Morton be responsible for flood control during REDRAMP, the staff and offices of the Provincial Travel and Publicity Bureau were made available. This staff and its offices were located in the legislative buildings where Flood Control Headquarters was established.

The offices provided ample accommodation and sufficient telephone lines. Within 24 hours radios were installed to monitor newscasts and official instructions and advice broadcast to the public by the five Winnipeg stations.

As the waters of the Red River rose and demands for information multiplied additional public information officers were brought in from federal depart-

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ments, commercial firms, the RCAF and the Royal Canadian Navy in the Winnipeg area and from Army Headquarters, Ottawa.

This demand for information from the public and newsmen is a phenomenon common to natural disasters and war. And the information issued to meet this demand is the main method of controlling and directing the public thereby saving lives and easing the problems of rehabilitation and recovery.

The public and newsmen in both disasters generated an almost overwhelming demand for information. Communities prepared to meet this demand afterwards reported that public information had been their major means of saving lives and controlling the public.

Communities that did not take this sudden demand for information into account in their disaster plan reported they had been unable to meet the situation adequately. In some of these communities the public and newsmen reacted strongly against the authorities who were overburdened by the combination of operational problems and the unexpected public information requirements.

Months before the hurricane, the Lake Charles community's news media had proposed the system used for public information and civic authorities had acted upon the proposal. After the experience of a previous flood, Calhoun County set aside an assembly room for the press and put the local newspaper editor in charge to see their needs were met. Reporters weren't allowed in the radio room or control centre but the editor obtained for them copies of everything authenticated.

But in another community "newsmen swarmed over control centres, picked up messages from desks and tied up the only telephone to call out their stories. A judge noted, 'We threw one man out twice—I think it was the second time that hurt his feelings.' "

During REDRAMP more than 50 newsmen and broadcasters arrived in the provincial capital of Winnipeg. This figure does not include representatives of the local news media nor the large number of photographers and cameramen who came from many of the metropolitan cities of Canada and the United States. The public information staff of REDRAMP provided a 24-hour service for these newsmen throughout the flood.

The following lessons are derived from the experiences described above:

a. *The public information factor must be studied and provided for in a disaster plan.*

b. *Qualified persons experienced in dealing with public information must be part of the headquarters staff thereby relieving departmental officers of the added burden of trying to answer an unceasing flow of questions in an unorganized manner.*

c. *A major item of the public information portion of the disaster plan is communications. Communications are needed by the public information staff to disseminate information to the news media and the news media representatives also need communications to transmit information to their organizations.*

d. *The public information communications must be separate from the operations communications which in a disaster will be too overloaded with priority traffic to transmit public information.*

However, the presence of a public information staff does not relieve other departmental officers, particularly the most senior civilian or the military commander, from personal public relations responsibilities. The public, and on their behalf the newsmen, will expect to be told periodically, at least in general terms, the details of the situation and what action is being taken and what is expected of the public.

A CARLA observer noted: "The most important thing in the whole evacuation was the fact that leaders had the guts to stand up and ask people to go that far in advance of the emergency." The report adds, "people were sitting there waiting to be told; they were all packed and waiting. They really seemed to want someone to order them out."

The REDRAMP report states: "It is necessary to inform and quietly influence the public if you are to control them in the difficult and dangerous circumstances surrounding an emergency. The newspapers and radio were most helpful to us but this pleasant situation might not always easily be arrived at. Care should always be taken to ensure that at least one news sheet is published in a disaster. And that one radio station can keep on the air; also that the public can hear it."

Each day at 10.30 a.m., Brigadier Morton attended a press conference with about 70 representatives from newspapers, broadcasting stations and the newswire services. He gave them the Flood Control Headquarters policies. An Intelligence Officer then outlined the current situation and was followed by departmental experts from Mines and Resources, civilian and army engineers, the Red Cross, etc . . . The newsmen then asked questions.

Extensive use was made of radio during the disasters. Radio talks by Brigadier Morton were judged one of the best means of influencing the public and throughout the crisis he broadcast periodically giving a frank summary of the situation. These broadcasts played an important part in encouraging some 100,000 persons to leave Greater Winnipeg before the situation became too critical. This voluntary evacuation would have been an even more important factor had the water risen only a few inches higher than it did. In any case, the substantial reduction in the number of residents did ease many administrative problem.

The foregoing extracts emphasize these lessons:

a. *Public information is a command responsibility. Leaders in disasters must be sensitive to the need to personally inform the public.*

b. *Leaders must appreciate the value of properly employing all available media to inform the public.*

c. *Officers, other than those engaged directly in public information, must be prepared to brief newsmen on request at scheduled press conferences*

But even if all the lessons recorded above are learned and practiced, the effectiveness of public information in a disaster still will depend in no small measure on the objectivity and skill in communications of the reporters, editors and broadcasters who address themselves to the public. The vast majority of newsmen are as anxious as officers responsible for disaster operations to be of service to their community and country. This is clearly evident in the CARLA and REDRAMP reports which indicate that most newsmen were careful to ensure they were disseminating facts and not fiction.

However, in both disasters there were erroneous reports that had or could have had serious consequences. They arose for a variety of reasons including: bad reporting; lack of appreciation by a newsman of the effects of his erroneous reports; failure to check the authenticity of information with authorities in possession of the facts; failure of authorities to provide adequate means for newsmen to check the facts and ineffective and excitable officers who provided newsmen erroneous information.

Here are some examples of erroneous reports during the disasters. A civil defence director in Hurricane CARLA noted, "News media, which had performed magnificently during the warning period, now, really came up with some dillies." The major of Freeport stated: "Erroneous news got out that Freeport and Brazosport were totally gone. A Fort Worth paper took up a quarter of the front page with a picture called ALL THAT'S LEFT OF FREEPORT. It showed one house above water. I went all over town and can't figure where that photographer found an angle that would show only one roof. There were hundreds of houses showing, and all our industry, even if standing in water. The picture caused great anguish to our citizens in reception areas. You can quote me". Some stations and newspaper received sensational erroneous reports from persons "monitoring a shook-up ham operator".

One radio announcer phrased the story in this ominous manner: "Freeport is left to the wind and water".

REDRAMP was not devoid of erroneous reports some of which could have had serious consequences. "At the start", the report notes, "we had trouble over wild and disturbing reports over the air about such things as breaks in a dyke or people wanted at once at a certain place. So my PRO approached the stations and they agreed unanimously to accept only items passed to them which had been approved by our office (Flood Control Headquarters). Later again, an announcement that 'the dykes at Point Douglas had gone and all were to evacuate' was made by one station. On investigation we discovered that this had been put out in good faith by the broadcaster, who was informed over the telephone that it had emanated from us. To prevent a recurrence we arranged a series of code words, known to the stations and changed daily, to prefix any official request from us. We agreed that the restriction should only apply to certain important reserved subjects, otherwise we left them free. The stations worked well together, releasing time to us and cherfully accepting national and regional hook-ups."

An incident which could have had serious consequences occured when a newsman issued an erroneous report that Flood Control Headquarters had announced that the crest had been reached and the water now would begin to recede slowly. Had this report received wide circulation it would have slowed the voluntary evacuation in progress and in all probability resulted in evacuees returning to Winnipeg too soon. The public information staff, fortunately, learned of this report as soon as it was issued and put out a denial almost immediately which reached the newspapers just before the presses began to turn for the first edition of the day. The denial also was passed to the newsman who issued the report. He was a man competent in his profession and of high ethical standards. A subsequent investigation indicated he had obtained the erroneous information from an officer who, *without authority and lacking sufficient knowledge, expressed the opinion* that the crest had been reached. Actually, the waters continued to rise, a fact about which the public information staff naturally had mixed emotions.

The lessons indicated are:

a. *A re-emphasis of the need to provide a qualified public information staff capable of quickly authenticating or denying the accuracy of information submitted to them by newsmen for verification. This also requires the efficient and speedy co-operation of all headquarters officers with the public information staff.*

b. *The need for facilities to enable the public information staff to monitor the reports being disseminated to the public.*

c. *The need for a method by which broadcasters and newsmen can authenticate telephone reports and requests from official sources.*

d. *The need to centralize authority to release official statements. However, care should be taken especially in large scale operations covering a vast territory, that this is not over-done. This*

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authority should be delegated to level-headed, knowledgeable senior officers who are in key headquarters and can and will check the facts.

e. *The need for reporters, broadcasters, editors and sub-editors to appreciate the serious consequences of disseminating what appears to be fact but is being looked at in isolation, not in the context of the over-all situation, and has not been authenticated with official sources.*

The importance of the last two lessons cannot be overemphasised but it should be noted that requiring, as they do, rapid decisions and sound judgment under the heavy pressure of a disaster, they are the hardest to practice with perfection.

However, CARLA and REDRAMP indicate much can be done by planning before a disaster and at least taking swift action during the event to improve the practice of these lessons.

During CARLA the public information arrangements for the community of Lake Charles were very effective. The news media themselves had proposed the system many months prior to the hurricane, as was stated earlier. But what was not said earlier and is emphasized now is this excerpt: "The news media had a self-imposed ban on scare headlines or unverified 'panic' stories." This self-imposed ban also had been decided upon by the media long before the disaster occured.

During REDRAMP all major newspapers and radio stations continued to operate. Television was not then in existence in Canada. But CARLA authorities reported being seriously hampered in getting instructions to the people when power went off and local radio stations could not broadcast. Power generators were rushed to many stations and some were provided with the last trickle remaining in the power system.

The urgent need to re-establish newspapers and radio stations knocked-out by the hurricane also was noted. In Galverston, Freeport, Texas City and Bay City, newspapers were put out of operation by flooded machinery, soaked newsprint, or power failures. Elsewhere reduced editions had to be published. Some newspapers carried copy to inland cities for printing, others worked round-the-clock to dry out machinery and recondition equipment. The lesson:

The need to assign a high priority to the re-establishment of public information media that have been knocked out during a disaster.

Today the lessons of REDRAMP and CARLA are as valid as in 1950 and 1961. Legislation now exists for the "Continuity of Government", a brief term to describe those measures taken to ensure adequate provision of leadership and those services, including information, that are essential to the survival of a nation and its people. The importance of adequate public information rests not in the fact that it will reduce the burden on those responsible for operations (though it will accomplish that) but that it will reduce casualties and speed recovery from the effects of natural disaster and war. ▲

There are two general ways in which fires can originate in a nuclear explosion. First, by the ignition of paper, trash, window curtains, awnings, excelsior, dry grass and leaves, as a direct result of the absorption of thermal radiation. And second, as an indirect effect of the destruction caused by the blast wave, fires can be started by upset stoves and furnaces, electrical short-circuits, and broken gas lines. No matter how the fire originates, its subsequent spread will be determined by the amount and distribution of combustible materials in the vicinity. It is seen, therefore, that the problem of the development of fires accompanying a nuclear explosion falls into two distinct categories:

(1) the number of points at which fires originate, and

(2) the character of the surrounding area.

EMO SHELTER PROGRAMMES

The following article was prepared by S. N. White, Survival Planning Officer with the federal Emergency Measures Organization.

Policy

There has been no change in shelter policy and this, therefore, remains one of encouraging the private individual to provide the protection necessary for himself and his family. This policy continues to be supported by the availability of loans under the terms of the National Housing Act.

Household Fallout Shelters

In pursuance of the above policy, a considerable amount of effort has been expended in the development of suitable household fallout shelters. Available to the individual now is a complete range of EMO shelter designs ranging from a cheap and simple shelter constructed of wood and sandbags to more costly and sophisticated models in reinforced concrete.

All these designs have been published either in the Blueprint for Survival series or on separate leaflets and have been in circulation for some considerable time.

In addition, some 115 commercial designs have been evaluated, approved and registered. These have all been assessed against the basic criteria for protection which have been established and they must meet these criteria to obtain approval.

Large Fallout Shelters

It will be recalled that during the summer of 1961, the Department of Public Works carried out a survey of some 5,000 federal buildings across Canada. The survey report has, of course, been completed for some time and from this, the costs of developing fallout protection in large buildings have been estimated. These costs are, at present, being studied in relation to the overall requirements for large shelters.

In this respect, the surveys which it is hoped are being carried out in the various provinces and municipalities will be necessary to develop a complete assessment of the availability of protected space as against the total requirements. Only when such information is available can final decisions be made with respect to the safest and most economical development of communal shelters.

As a follow-up to the DPW survey, the Department of Mines and Technical Surveys has, during the past summer, been carrying out a survey of all suitable mines across Canada with a view to determining their potential use as fallout protection. This survey is nearing its completion at present and although the report will take some time to compile, it is expected to be available during 1963.

An interim report indicates that:

a. Relatively few mines could serve as immediate shelter for densely populated areas.

b. Serious difficulty of access to shaft-serviced mines is apparent.

c. Environmental factors are critical.

d. Volumes and areas in underground workings however are of great magnitude and offer some outstanding prospects for future use.

Particularly interesting are mines which are established in bedded deposits of industrial minerals and in iron ore. Notable examples of the more promising locations are the following:

Mine	*Probable Volume cu. ft.*	*Usable Area sq. ft.*	*Nearest Large Centre*
Hagersville	20,000,000	5,000,000	Hamilton
Ojibway	90,000,000	5,000,000	Windsor
Dotmar No. 1	20,000,000	2,800,000	Hamilton
Dotmar No. 2	20,000,000	2,000,000	Hamilton
Wabana	300,000,000	20,000,000	St. John's, Nfld.
Pugwash	8,000,000	400,000	—
Gaspe	200,000,000	2,000,000	—

Some underground mines in vein-type deposits offer possibilities as local shelter near substantial populations. Among these might be included the dozen mines in the Sudbury area, mines in the Eastern Townships, and the Britannia mine, 30 miles from Vancouver. The latter offers* adit-access, very large volume, and area conservatively estimated at 400,000 square feet.

In addition to the above, the Emergency Measures Organization engineering staff has recently turned its attention to the problems connected with designing dual-purpose communal fallout shelters and hopes, by the end of 1963, to have suitable designs available for those who may require them.

*Horizontal Entrance.

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Training

In order to assist provinces and municipalities in carrying out their surveys, the Emergency Measures Organization manual *An Engineer Looks at Fallout Shelter* was produced and issued late in 1961. Intended for professional persons such as engineers and architects, the book has been distributed to such an extent that a second printing has been necessary.

In addition, a number of courses have been run in the techniques of shielding analysis; and to these, all provinces have been invited to send suitably qualified personnel. This is a highly concentrated course and candidates are examined in the procedures they have learned prior to leaving Arnprior. Those who pass the examination successfully are awarded a qualifying certificate and are, in the opinion of this organization, competent to supervise or carry out fallout shelter surveys. Some 133 engineers and architects have already received such qualification.

The value of this training will be apparent when it is realized that those provinces which have submitted fallout shelter survey projects under the Financial Assistance Programme have been informed that the acceptance of such projects is conditional upon the employment as supervisor, especially in computation, of one of the men holding an Arnprior (or similar) qualification in shielding analysis.

Blast Protection

Having developed the techniques of fallout protection to a satisfactory extent, it has become possible to concentrate some attention on the problems of blast protection. Since this is inevitably associated with protection against all other nuclear weapon effects simultaneously, the problems are somewhat complex. In addition, the techniques for evaluating the performance of structures when exposed to blast overloadings are in their infancy and cannot yet be called an exact science. It is therefore necessary to develop our knowledge in these areas very considerably.

Despite this, however, there has been, and continues to be, a demand from members of the public for blast shelter designs. This demand has been met in part by the publication of *Blueprint for Survival No. 6 "Blast Shelters"* together with the following designs and specifications:

a. Plans and Specifications for Family Blast Shelter (10 psi)

b. Plans and Specifications for Family Blast Shelter (30 psi)

c. Plans and Specifications for 30-person Blast Shelters.

A substantial number of commercial designs have been evaluated and approved. Because of the lack of knowledge referred to above, all present designs tend to over-insure, and blast shelters at present are therefore costly.

Shelter Testing and Research

There is a continuing requirement to improve our designs and the advice given to the public and others. A similar requirement exists for the extension of our knowledge in all fields associated with protective construction. In all these matters a great deal of research is carried on in the United Kingdom, the United States and other NATO countries and we are in a position to derive considerable benefit from this.

There are, however, various problems which are peculiar to Canada and which have not therefore been investigated elsewhere. An example of this is the environmental conditions pertaining in shelters during the Canadian winter. For the past two years, the National Research Council has been investigating this problem together with the problems associated with the use of various heating and lighting methods. While this work is not yet complete, it has already yielded information of considerable value which has enabled our technical staff to be more precise with respect to criteria affecting conditions within the shelter. It has, for instance, been established that the temperature in an occupied basement fallout shelter is unlikely to fall to critically low temperatures, and that it is possible to maintain it at comfortable temperatures by the addition of heat from simple appliances. Ventilation under summer and winter conditions has been shown to be satisfactory. Finally, the research has enabled us to be quite certain on the best types of appliance and fuel to use. Kerosene still appears to be the safest fuel; and the safest type of appliance, that in which the rate of fuel supply is governed by the rate of burning.

Because of the considerable gaps in the knowledge of structural response to blast overloading, the EMO has, in close co-operation with the Defence Research Board, commenced a programme to study the performance of EMO-designed blast shelters and their component parts. The object of such testing is of course to develop better protection at a lower cost. To achieve this is naturally a long-term project which should nevertheless each year yield its crop of material benefits.

The programme includes investigation of the following items:

a. improved concrete shelter designs;

b. buried shelters of both sheet metal and fibreglass;

c. various items of shelter equipment such as:

(i) blast valves—new design

(ii) shelter doors and fastenings;

(iii) air ducts, air blowers and hand-operated valves.

The practical part of this programme is carried out at the Defence Research Board Experimental Station, Suffield, Alberta, and some of our current designs have been and will continue to be tested.

The past year's trials yielded important information which will enable us to improve the design of the entrance ways to our buried steel shelters, and indicated a need to improve the door fastenings on the concrete shelters. In addition, the analysis of the performance of the concrete shelters will enable us to make some progress towards designing a more economical concrete shelter. ▲

YOUR EMERGENCY BROADCAST RECEIVER

THE principal means of passing instructions and information to the public during a national emergency will be through the use of all broadcasting media, i.e., AM and FM radio and TV (sound channels).

As normal electric power may be disrupted, the provision of standby power at some broadcasting stations is part of the emergency broadcasting plan but, even then, many stations may go off the air because of power failure.

For the same reason, many receivers may become inoperative and it is therefore essential that every household should have a battery powered "standard band" radio receiver and that it should be capable of receiving stations including other than local stations.

The Department of Transport has studied this subject, in conjunction with the radio industry, and has produced a Specification (*Radio Standards Specification No. 159* of April 1, 1962) as a guide to manufacturers. Although no manufacturer has yet applied for approval of their sets under Specification 159, the Department of Transport was aware that several sets on the market could meet these standards at the time the Specification was released.

Individuals will naturally buy the best receiver that they can afford, but the following pointers may be of assistance:

a. The set should be reasonably sensitive and capable of receiving an AM broadcasting station in the day time which is located at least 50 miles from your residence and which is peferably not located in an area designated as a Target Area.

b. The set should be a portable, battery powered type, using flashlight batteries, which should be replaceable without difficulty. It should be capable of operating on one set of batteries for 12 hours per day for at least 14 days.

c. There should be provision on the receiver for the connection of an external antenna. An external antenna is essential if the radio is to be used in any shelter or building with steel reinforced construction, since a broadcasting station's signal level received inside such a building would be seriously reduced or even eliminated. In an average residence, the outside antenna would also increase the signal level from distant stations.

d. The internal construction of the set, as well as the case, should be rugged, so that it could take some rough handling and continue to perform well. ▲

DAMAGE ASSESSMENT

The following United States note on the national systems for damage assessment and analysis of resources in nuclear attack is reprinted from a NATO *document.*

DAMAGE assessment is the process of determining the effects of enemy attack (hypothetical or real) upon human and material resources of the Nation. Its purpose is to estimate the amounts, locations and conditions of remaining resources so that intelligent decisions for the survival and recovery of the Nation can be made.

2. An effective system of damage assessment is also necessary during a preattack period. This preattack system is generally called vulnerability assessment. The knowledge gained from such analysis provides a basis for intelligent decision in preattack planning for postattack operations at all levels of government; that is, it can be used in developing the actions necessary to assure continuity of postattack operations and supplies required. This knowledge is equally essential for continuous evaluation of the effectiveness of civil defense activities, such as a shelter program; warning and communications system, radiological defense measures, etc. In addition, it can be used effectively for reducing vulnerability, e.g., the estimating of the most advantageous locations for emergency operation centers, a determination of the structural requirements for such centers, development of stockpile programs, the location of such stockpiles and it can provide information to industry on plant location.

3. Regardless of whether the vulnerability analysis or an assessment of actual damage is undertaken, certain requirements for information must be met. The first of these is a system for the location and distribution of the preattack population and material resources. This system may be based upon latitude and longitude, Universal Transverse Mercator (UTM) or any other system which will permit one to measure the distance from the resource point to ground zero. Once this has been determined, an analysis of the population and material resources must be performed in order to see whether or not it will be desirable to aggregate resources at selected points within the location system or whether the resources should be considered on an individual basis. Furthermore, with the collection and aggregation of the resources data, it is necessary to provide a measure of the vulnerability of the resource or the vulnerability of the storage site of the resource to nuclear weapons effects.

4. A second requirement for an assessment system is the ability to determine the attack pattern data including the location of ground zero, the height of burst at which the weapon was detonated, and the weapon size or yield. Additionally, it is necessary to have information available on the meteorological conditions existing at the time of attack, since these data are necessary for estimating the extent and direction of fallout.

5. A third requirement is the obtaining of technical data on weapons characteristics and the effects which these weapons have on various resources or resource storage points.

6. Finally, for the assessments of population, it may be necessary to obtain the time of detonation and any protective actions which the population might have been able to take.

7. There are two basic methods for performing assessments of damage, e.g., computers and manual systems. However, regardless of which of the two is used, the above requirements must still be met. Obviously, the computer can handle greater quantities of data in a much more rapid and perhaps accurate manner than can a manual system. On the other hand, for many areas, the quantities of data to be processed may not require a computer and we may find that a manual system is perfectly satisfactory. In any event, a manual system can provide valuable insurance in "back-up" support to a computer operation.

8. In the U.S. we generally conceive of using the computer for Federal Government assessments. On the other hand, we generally assume that practically all assessment for states and localities will be done manually.

9. As is obvious from the above statement, we have been discussing a system of damage estimation rather than a true damage assessment. In order to provide as much information and intelligence as possible to those who are responsible for decision making, in the immediate postattack period, we have developed this statistical approach to the assessment situation.

10. In proceeding toward the reporting and analysis of actual damage, we have arranged for a photo-reconnaissance system designed to provide more ac-

curate estimates. The Tactical Air Command of the U.S. Air Force has been assigned this responsibility of photo-reconnaissance. TAC has made aerial photographs of potential targets preattack. After an attack, it would re-photograph the areas of detonation. By comparing and studying the postattack and corresponding preattack photographs, a photo-interpretation would produce revised damage assessment data.

11. The final stage of postattack damage assessment, and in fact the one to which the earlier estimates and the photo-reconnaissance have been working, is that based upon on-site inspection.

12. Arrangements are being made with agencies of the Federal Government to report actual status of damage in resource areas in which they have competence. The State and local government agencies will also be included in this system of reporting actual damage.

13. One of the major inputs to the postattack damage assessment system is the continuing collection of radiological intensity information from the national network of monitoring stations. These data are essential to the decision making process.

14. Finally, arrangements have been made with the U.S. Bureau of Census to undertake a rapid sample survey in order to determine the number and distribution of survivors and survival resources. ▲

CONTROL OF RADIOACTIVE FALLOUT IN WATER SYSTEMS

Foreword

The Department of National Health and Welfare has published this Manual as a guide to assist engineers in their task of providing potable water in their communities in the event that Canada is subject to attack by nuclear weapons.

The problem of supplying safe water under these conditions will depend on the physical damage to the water system and damage to the system of radioactive products, with the relation of these factors to the efficiency of the natural and mechanical processes through which the water passes in reaching the consumer.

A great deal of information is available on problems associated with blast damage, but that of radioactive contamination is less understood. In order to assess the potential hazard and make adequate preparations, waterworks engineers must be able to assess the amount of contamination which could enter their water supply by various routes and how to estimate the reduction of the damage by water purification methods and use in their locality.

The purpose of this Manual is to set out the relevant techniques together with the necessary graphs, charts, and other data which will enable water engineers to carry out a survey of their own systems; and from the survey, evaluate the potential hazards and hence, identify the nature and magnitude of suitable emergency preparations.

(*Signed*) JUDY LAMARSH
Minister of National Health and Welfare

CHART

CONDITION	WHAT TO OBSERVE	WHAT TO DO	WHAT TO REPORT
1. Shock Failure of circulation. Every injured person may be in shock and should be regarded as such until diagnosis is made. Evidence of shock may be delayed.	Weakness and faintness. Dizziness and nausea. Skin pale, cold with perspiration. Eyes vacant and lack lustre. Rapid heartbeat and therefore rapid pulse. Air hunger—breathing shallow and rapid with later, irregular, sighing respirations. Excessive thirst. Signs of external or internal haemorrhage.	Notify doctor at once. Conserve body heat but do not overheat; maintain normal body temperature. Later may need to apply external heat. Tilt patient so that blood tends to flow to upper portions of the body. Head and chest should be about 6-12 inches lower than the rest of the body. Give other care as ordered.	Symptoms of shock: Air hunger. Rapid pulse, growing weaker. Excessive thirst, mouth dry.
2. Cuts and Wounds	Location of cuts and jagged wounds. Bleeding. Glass or other debris in wound. Symptoms of shock or signs of internal bleeding that resemble shock (some puncture wounds may be deeper than first suspected). Evidence of pain. Discharge, amount and odour. Swelling. Discolouration, red streaks leading away from wound.	Keep wound clean and covered—apply sterile dressing. Support affected part and, if sensitive, prevent weight of bedclothes. If bleeding shows through dressing, apply fresh dressing over original dressing, using slight pressure. Later, doctor may order movement of affected part to help prevent stiffening of joints.	Symptoms of chock or internal bleeding. Changes in colour, odour, or consistency of discharge from wound. Swelling about the wound. Red streaks leading away from wound. Evidence of foreign object in wound.
3. Haemorrhage	External: Force—dripping, spurting Amount. Colour, bright or dark red. Location. Internal: Air hunger—gasping or deep sighing. Rapid pulse, growing weaker. Sense of smothering. Excessive thirst, mouth dry. Restlessness. Skin cold, clammy, pale, or bluish. Apparent source, such as lung (frothy), rectum or other.	Notify doctor or nurse at once. Reassure patient; keep him quiet. Keep patient comfortably warm. Supply fluids unless otherwise ordered. Begin with about 1 cupful every hour if tolerated. (No stimulants.) If external: Apply sterile dressing and bandage; apply pressure over the dressing to help control bleeding. If internal: This is an emergency which can be handled only at a hospital. The patient should be transported as quickly and as comfortably as possible to a hospital.	Air hunger. Rapid pulse. Excessive thirst. Fall in temperature. Skin: cold, clammy, pale or blue. Continued bleeding.
4. Burns	Reddened skin, accompanied by pain—first degree. Blisters with some pain—second degree. Cooking or charring, usually little pain except around edges of wound—third degree. Extent of burns: Particularly dangerous if large areas of body surface involved, such as face, arm, back, or chest, in which case shock is likely to develop. Evidence of infection.	Treat for shock. Leave face unbandaged. Expose wound, removing only large, easily separated foreign particles, such as clothing or debris. Apply thick, dry, sterile dressing; avoid wrinkling and overlapping. Apply separate dressings to each finger or toe. Bandage firmly. Give medication as ordered by doctor. Keep patient comfortably warm. Give general nursing care, keeping body in position to help prevent deformity. Give fluids—about 1 cupful every hour unless otherwise ordered. Measure and record fluid intake and urine output.	Symptoms of shock. Any sudden rise in temperature, which may indicate infection. Change in urinary output—amount. colour, odour, or evidence of sediment.
5. Fractures—Simple and	Pain upon motion or tenderness of injured part.	Keep injured part in good position at all times. Get plenty of help when moving patient to avoid	Any unusual swelling around bandage or cast; any blueness, swelling, or numb-

Simple and Compound	Inability to use injured part. Patient sometimes moves part below break. Deformity (meaning out of normal shape) sometimes detectable. External wound—bone may protrude in compound fracture. Swelling, blueness, or numbness of toes or fingers if in cast or bandaged. Complaint of pressure or pain under cast or bandage. Evidence of loose cast or bandage. Evidence of pressure sores.	Get plenty of help when moving patient to avoid further injury. Provide support for correct position and for comfort, such as pads, pillows, etc. If patient is in traction, keep traction taut (without slack) at all times. Keep skin clean, dry, and free from pressure.	cast; any blueness, swelling, or numbness of protruding parts, such as toes, or complaint of undue pressure at any particular point. An injured part moving too freely within bandage or cast. Any indication of pressure sores or reddened areas on skin over bony prominences. Inability to move any part of body.
6. Severe Bruises and Crushing Injuries	Discoloured areas of skin—black, blue, red. Flattened or mashed extremities, with accompanying bleeding. Evidence of pain. Difficulty in breathing if chest injury. Discharge. Break in skin.	Give general nursing care. Force fluids (alkaline) every hour, if possible. Elevate and support injured part in correct position. Apply heat or cold only when instructed to do so. Treat any break in the skin as an open wound. If chest injury, causing breathing difficulty, keep air passages open by turning head to one side to allow fluid to run out.	Discharges from or change in colour and texture of injured part. Change in colour or amount of urine. Symptoms of shock. Change or difficulty in breathing.
7. Concussion and Other Head Injuries	Complaint of headache. Period of unconsciousness. Unusual behaviour—may be excitable or stuporous. Heavy breathing. Bleeding or discharge. Vomiting, especially when forceful. Swelling or lump on head. Face flushed or pale. Evidence of dizziness, pain, or convulsions.	Keep patient lying down. Provide warmth. Apply sterile dressing to any wound. Avoid giving fluids until ordered by the doctor. Avoid giving alcoholic beverage or stimulants, such as coffee, tea, or cocoa. Avoid swabbing inside ears or nose if there is bleeding. Count pulse frequently during the first 24 hours to note any change in rate or condition. Measure fluids given and output of urine. If breathing is difficult, keep air passages open by turning head to one side to allow fluid to run out and, if necessary, push lower jaw forward by pressing on the angle of the jaw just below tip of ear.	Bleeding: indicate source, such as from ears, nose, or open scalp wound. Rise in temperature. Sudden change in pulse rate. Forceful comiting—explosive. Symptoms of shock. Deep unconsciousness.
8. Radiation Sickness	History of nausea or vomiting (or both) soon after the attack. Sore mouth or throat. Bleeding from bowel, nose, etc. Sudden hair loss. Purpura. Rescue or escape from area contaminated by radioactive fallout.	Keep patient away from others who have a communicable disease, such as a cold. Keep all wounds clean and covered with sterile dressings. Keep patient as quiet as possible. Give general nursing care.	Signs of shock. Nausea and vomiting. Bleeding from gums or other mucous membrane. Enlarging bruiselike areas on skin (purpura). Bloody diarrhoea. Evidence of sore throat. Rise in temperature. Slow healing of wounds and burns. Vague general illness especially in injured or burned patients.

9. Bring the following equipment to your duty station:

(a) Thermometer with case. (b) Dressings. (c) Triangle bandages. (d) Flashlight with extra batteries. (e) Razor blades and holder. (f) Pencils—one ordinary and one skin marking. (g) Note book. (h) Standard Insignia.

ESSENTIAL POINTS TO REMEMBER

1. The need for professional guidance—where and how to obtain it. 2. The value of practicing skills to develop confidence. 3. The importance of keeping calm and giving assistance in time of crisis. Skill inspires self-confidence; a well-grounded faith in one's own ability is a primary requisite for service to others; training and preparation build security for yourself, your family, your community, and the nation.

THE VETERINARY PROFESSION IN CIVIL DEFENCE

The following article was prepared by Dr. R. D. L. Walker, Veterinary Advisor, Emergency Health Services.

TOGETHER with the medical, dental, nursing and other allied professions, the veterinary profession has an important role in maintaining a strong national defence. Probably our greatest service is in disease prevention and insuring the provision of a safe food supply in adequate quantities, so as to maintain the health, welfare and morale of the human population at the time of, and immediately following, a national emergency.

The training a veterinarian receives in disease control, bacteriology, pathology, radiology, meat and milk hygiene and animal husbandry, makes him an ably-equipped individual capable of taking his place on any team responsible for carrying out certain requirements for the Civil Defence authorities.

Since the early days of World War II, much has been said about biological warfare. The vulnerability of livestock on the North American continent to the various known exotic diseases that might be introduced through nefarious channels into our midst has received serious consideration. It is a well-known fact that by introducing any one of many of these disease agents our food supply could be rapidly curtailed. Then, again, we must not lose sight of the fact that while diseases communicable from animal to animal could produce serious economic effects, many of these animal diseases are communicable to man. Such diseases could have a detrimental effect on the health of the livestock producer who might be the first to come in contact with such an infective agent, and not only would it possibly affect and limit his production capacities but through him a source of transmission might easily be commenced through human contacts. It is thus apparent that we must at all times be prepared to cope with the introduction into our country of foreign diseases through any channels whether by accidental or deliberate means.

The state of a nation's economy is dependent on the presence or absence of animal disease. With the existence of disease, a direct result is the loss of livestock resources. Proper control of such diseases is important in helping to provide an adequate supply of products of animal origin, as is also the prevention of new diseases being brought into our country or community.

It must be realized that the primary object of biological warfare is man, and either directly or indirectly through biological and other weapons, to limit the food supply. This is the essential reason for the veterinary profession to be given the responsibility for providing the defensive means to protect man on the one hand, and the livestock industry on the other.

There are many diseases in the world today affecting all species of animals and birds. These may vary from those having only a slight debilitating effect to those that carry with them an extremely high mortality. Many of these affect man. Some may be endemic in various areas while others may only appear sporadically, but all are capable of being transmitted from one part of the world to another.

In North America, both Canada and the United States enjoy a freedom from known dangerous and devastating epizootic diseases. True, on odd occasions, one or both of these countries have experienced some of them, but so far we have been successful in preventing the establishment of any of them in our countries. Some of these diseases have periodically ravaged the animal population in many parts of the world causing almost complete destruction of herds and flocks. In those countries of the Orient, for instance, where they have failed effectively to control the more dangerous animal diseases, a poor state of livestock and agricultural industry exists. This is one of the major contributing factors to the serious food shortage throughout the world.

A nation's welfare in the livestock and poultry industry depends on regulatory veterinary medicine. This industry provides a livelihood to farmers, stock handlers, tradesmen and others and it is subject to constant threat from diseases that could decimate herds, wipe out profits and endanger the health and lives of consumers. Every livestock owner realizes that the major portion of the food production job is to maintain a high level of animal health for himself, his veterinary practitioner and the nation. He knows the necessity for cooperation with local, provincial and federal authorities to mobilize the full aid of science and make effective such measures as each situation demands.

This philosophy of shared responsibility in the prevention and control of animal disease is the basis of regulatory veterinary medicine.

Throughout the world, it is recognized that Canada has a well-controlled regulatory program—second to none—aimed primarily at preventing the introduction of dangerous disease agents into our country. We are well-equipped to implement adequate control measures against diseases under ordinary conditions and we seriously hope to be able to cope successfully with any emergencies that might occur. However, it must be remembered that no matter how precautions may be rigidly and effectively enforced, there will always remain the possibility for some diseases to gain entrance, more so in times of war, either by accident or through deliberate acts of sabotage. We maintain quarantine stations on the ocean coasts and spotted at strategic points along our international boundary, and to date, we have managed to keep Canada comparatively free from epizootics.

With the introduction of the aeroplane into the field of livestock transportation, we have had to prepare for graver problems. Boat shipments from foreign countries would require 15 to 40 days in transit and this was generally sufficient time for any disease to develop that could be dealt with on arrival. But with flight times over similar routes ranging from 12 to 24 hours, diseases in the incubative stages might still not develop prior to landing. This required almost a complete revision of our quarantine regulations.

The regulatory veterinary operating agency of the Government of Canada is established within the federal Department of Agriculture, known as the Health of Animals Division, with a head office in Ottawa and administered by the Veterinary Director General. This Division administers two Acts of Parliament together with the regulations made under authority of these Acts. These are the Animal Contagious Diseases Act and the Meat Inspection Act.

It must be understood, however, that our federal force, that of the Health of Animals Division, is entirely too small to be depended upon alone for the detection of foreign diseases or to continually be in the position to observe unusual manifestations of endemic diseases that might otherwise appear in our country. We must at all times work with and maintain a close liaison with the veterinary practitioners, public health authorities, diagnostic and research laboratories and through other allied channels in order to be prepared to deal with these disease problems. It might be of interest here to draw attention to the fact that the entire active professional membership in our provincial and national associations numbers slightly under the two thousand mark.

We have been particularly fortunate during these post-war years to maintain a small but well-trained group in our Division who are fully conversant with the various exotic diseases that are endemic throughout the world. From time to time this group arranges instructional courses for the members of the Health of Animals Division, and by this means we are gradually building up a field staff fully indoctrinated and more conversant with these specific foreign disease entities than they might ordinarily have been.

By way of passing mention, we list among the diseases of animals transmissible to man, such infections as glanders, anthrax, psittacosis, tularemia, yellow fever, brucellosis, equine encephalomyelitis, louping-ill, Rift Valley fever, bubonic plague, etc. Serious infectious (exotic) diseases of animals are rinderpest, contagious bovine pleurapneumonia, fowl plague, African swine fever and its American counterpart, hog cholera, the vesicular diseases such as foot and mouth disease, vesicular stomatitis and vesicular exanthema, blue-tongue, scrapie and sheep pox and numerous others—any one of them being capable of disrupting the livestock economy of our country.

The second important function of the veterinarian is associated with the provision of a safe food supply. The meat and food inspection services provided by the Health of Animals Division is recognized as one of the foremost in the world. Part of our meat inspection service is kept at a minimum through the activity of our other services in the prevention and control of diseases that might prove dangerous through human consumption. The Meat Inspection Service is responsible for the regular supervision of all meat processing establishments operating under federal veterinary inspection for certification of meat and meat food products for export, and also the inspection of such products entering Canada under import licence. During 1959-60 we had 198 establishments operating under licence and inspection. The Inspection Service also includes supervision over cold storage plants and dry storage premises numbering 144 where inspected meat and meat food products are stored.

Our Meat Inspection Service includes the study and approval of meat processing plant construction, and ante-mortem inspection at stockyards and abattoirs to eliminate animals affected with disease and other unwholesome conditions. In the slaughter houses, post-mortem inspection is carried out on each carcass to eliminate diseased and otherwise unfit meat. In processing plants the inspection includes the handling of meat to insure cleanliness and wholesomeness during their preparation into articles of food. Our staff must inspect and guard against the use of harmful preservatives and deleterious ingredients, oversee the proper labelling of all meat products and perform other associated duties.

By way of interest, it might be somewhat astonishing for one to learn that in the 1959-60 fiscal year, the total inspected slaughter in Canada was:

		Condemnations	
		Carcasses	Portions
Cattle	1,744,185	9,157	1,070,057
Calves	676,371	5,685	62,040
Swine	8,020,763	20,911	3,087,644
Sheep & Lambs	569,746	1,560	167,259
Poultry	47,960,177	528,821	2,262,729
Horses	21,462	131	14,775
Bison	938	12	210

The main causes of carcass condemnations listed are:

Cattle: Emaciation and mucoid degeneration, septicemia, pyemia, peritonitis, pneumonia, extensive bruising, pericarditis, nephritis and mastitis.

Calves: Immaturity, emaciation, imperfect bleeding, pneumonia, pleurisy, pyrexia and septicemia.

Swine: Emaciation, general debility, pneumonia, pleurisy, septicemia, extensive bruising and peritonitis.

Poultry: Emaciation, general debility, peritonitis, tuberculosis, pericarditis, leukemia, septicemia and bruising.

We realize that in the progress of this nation, our responsibilities regarding a safe food supply will increase—more so in the event of civil defence emergencies. Probably one of the most important factors at present would concern the handling of animals, meat and meat food products if exposed to thermonuclear activity—that is, through exposure to blast and fallout. These might well have been contaminated through direct external exposure or contaminated through ingestion of exposed food and water, or through inhalation, or by absorption of heavy dosage through the skin.

It is becoming more common knowledge from day to day that the role played by animals in the cycle of waste fission products is an important problem facing the medical and veterinary professions in dealing with the hazards of radiation.

The chain from the atomic reactor to the food animal and finally to the human consumer must be clearly understood. Veterinarians are well qualified to assume much of the responsibility in general public health matters associated with nuclear energy because the problem so often becomes intimately associated with animal physiology and health.

Training in radiological hygiene is essential as well as the study of radioisotope techniques for use in research and veterinary clinical medicine. This is being carried out as much as possible in our profession as time and opportunity permits.

It is not our intention to present a dissertation on the hazards of radiation exposure. However, it may be well to mention some of the more important facts that permit us to be somewhat optimistic in dealing with contaminated animals for food purposes.

Naturally the first requirement will be the presence of trained personnel capable of using the various contamination survey instruments and establishing the degree of exposure. We now have, and expect to have more of our professional staff suitably trained for this purpose and located at most of the strategic centres.

Meat animals subjected to fallout may be thoroughly washed off to remove the external radioactive elements, and if required for food, may be slaughtered immediately. The only care necessary is the proper removal of the hide to prevent contamination of the edible portions. In case of ingested or inhaled fallout, the body organs and the hide will have to be properly discarded and the disposition of the carcass made only after a thoroughly conducted radiological examination.

Radioactive fallout contains many radioactive isotopes but those of Strontium 90, Iodine 131 and Cesium 137 are of most significance as radiation hazards. In the food chain, the biological cycle permits an animal to be exposed to these elements internally either directly through the skin or by ingestion or inhalation, or indirectly through the plants which have become contaminated by absorption from the soil through the root system or from contaminated water sources.

Strontium 90 is of primary importance as it behaves much like calcium in soils, plants and animals. It is taken up in the biological systems, secreted in milk and collects in bone. This element deposited in any significant amount in bone can produce serious consequences including bone cancer and leukemia.

Iodine 131 penetrates the biological system and collects in the thyroid gland. Early acute hazards can be serious, particularly to children through drinking contaminated milk.

Cesium 137 is somewhat similar to potassium and when consumed and absorbed, will be found primarily in muscle tissue, but fortunately it is not retained in the body.

Thus it will be seen that with the element Cesium not being of too serious a consequence and Iodine and Strontium being concentrated in the thyroid gland and bone, the food value of exposed animals is not greatly damaged. By proper handling, such exposed animals can be boned out and the muscle tissue made available for food. It has been demonstrated in rather limited experimental studies that meat carcasses and meat food products exposed directly to radioactive fallout do not reveal any great dispersion of contaminating elements through the tissues. Thus by proper use of the detection instruments, the outside exposed area can be stripped away in ¼-inch, ½-inch, etc. thicknesses, leaving the under sections safe for food use.

In the early days of World War II, the Health of Animals Division was responsible for the formation of the Animal Health Emergency Organization. This was established as a means of meeting the biological warfare threat and all planning was carried out with

meticulous care. In reality it was a stepped-up version of the normal peacetime activities of the Division, in which emphasis was put on the early reporting of suspicious or unusual conditions in livestock, followed by immediate quarantine and action by the federal regulatory officials until a definite diagnosis had been established. This organization was formed on a dominion-wide basis functioning through a National Committee in Ottawa, headed by the Veterinary Director General, and having sub-committees at provincial and local levels. This was regarded as giving promise of a centralized activity with minimum delay in the event of any emergency.

The Animal Health Emergency Organization still remains as an established organization, maintaining direct liaison with various services of the Department of National Health and Welfare and Civil Defence authorities. The reporting of animal diseases is more directly administrative than that of human diseases because of the statutory distribution of responsibility and authority. Human health is primarily a provincial concern, whereas animal health is the charge of the federal authority as provided in the Animal Contagious Diseases Act. Thus one will understand the responsible part we have to play and carry out at the federal level. Actually this means that the Animal Health Emergency Organization is designed to carry out its regular functioning control program in case of emergency with complete cooperation from the various agencies concerned.

From experience in disaster emergencies, it is quite clear that the veterinarian can be expected to devote his professional talents and technical training to assist the Civil Defence authorities in every capacity. The veterinary profession is a public service profession and is always willing to serve in times of need. In fact, with no intention of being ironic, there is more than an element of truth in a statement that was made by an eminent authority not too long ago, when he said that "during any emergency, what is the use of striving to save life if food is not available for continued sustenance".

The Paramedical Role of the Veterinarian

The veterinarian has a responsibility to livestock and human health, but probably, by far, of most importance, is to safeguard the nation's food chain. The food supply can be drastically reduced through biological, chemical or thermonuclear means, unless a properly organized profession is available to accept the responsibilities necessary to assist in the provision of an adequate and safe food supply.

Co-operation with the public health authority at every level of government can be supplied by veterinarians trained or experienced in public health, in the event of any emergency.

Veterinarians, particularly those engaged in practice can be of assistance in a paramedical role by aligning their professional capacities with the medical authorities in the Emergency Health Services. Actually during the first 72 hours following a nuclear detonation all those with any experience in first aid will be needed to assist in the handling of mass human casualties.

The "Summary Report on Emergency Medical Care" published by the American Medical Association, recommends that veterinarians, together with other professional groups, be trained and expected to assist in the performance of specific tasks. For this purpose the following are enumerated—

1. First aid. To provide artificial respiration, relief of pain, treatment of shock, and preparation of casualties for movement.
2. Control of haemorrhage.
3. Proper and adequate cleansing and treatment of wounds.
4. Bandaging and splinting.
5. Administration of anaesthetics under medical supervision.
6. Assisting in surgical procedures.
7. Administration of whole blood, plasma and other intravenous solutions as directed.
8. Administration of parenteral medications as directed.
9. Catheterization and tracheotomy.
10. Administration of immunizing agents as directed.
11. Sanitation. Includes waste disposal, examination of water sources, methods of water treatment, water distribution, checking milk sources and methods of sterilization and distribution, and, the inspection of foods, to include the detection of radioactive contamination.

Modern veterinary hospitals have x-ray machines, autoclaves, sterilizers, surgical and diagnostic instruments, splints, dressings, bandages and drugs, and many other materials usable in the treatment of man on an out-patient basis. These hospitals on the periphery of large cities or in satellite towns and villages, could well be utilized as first-aid centres.

In another way the services of veterinarians could be made use of as part of the Emergency Health Services personnel allotted to mobile columns ready to assist in disaster areas. ▲

HEATING AND VENTILATING BASEMENT FALLOUT SHELTERS

The following article was prepared by Dr. N. B. Hutcheon, Division of Building Research, National Research Council.

MOST of the physical problems in shelter habitability arise from the necessity to keep the cost of protection to a minimum, coupled with the fact that normal practices may not be appropriate or even possible. In particular, the loss of the normal electrical energy supply, which in general must be assumed, creates special problems with heating, ventilating, cooking and lighting in shelters, and it is with these factors that this article will be mainly concerned. It will be limited to the small fallout family shelter of the basement type.

The loss of normal electricity supply will render inoperative most oil burners and all powered ventilation and air distribution systems unless a standby generating unit and an adequate fuel supply can be provided. It may be possible to operate some gas furnace systems without electric power in order to produce heat, if the gas supply continues, but the heat distribution part of the system which depends on a fan will be shut down. The majority of oil furnaces depend upon power and also burn furnace oil of a grade which cannot readily be used in simpler appliances, so that the supply of fuel on hand at the time of emergency may be of little use. The simpler oil heaters do not depend on electric power, but require a grade of fuel known commonly as stove oil, and cannot successfully be employed to operate on any residual supply of furnace oil. In any event, the operation of any normal gas or oil furnace systems or of oil heaters of any substantial capacity requires a chimney for discharge of gases to the outside. Under fallout conditions only, without prior blast effects, the normal chimney or vent may be operative, and may be used to advantage, but in other cases the disposal of gases of combustion from emergency heating appliances may be a difficult problem.

It is technically quite feasible to provide standby engine-generator sets for individual household use. Gasoline engine sets of 2,000 watts capacity are available for as little as $400.00. This capacity would permit continuing operation of furnaces and refrigerators and would provide for limited lighting and cooking. A very considerable amount of heat could also be recovered from the engine as a by-product. The storage of the necessary gasoline supply, as much as 6 gallons per day of operation or two 45-gallon drums for a two-week emergency period, poses problems of underground storage for safety. Diesel engine sets which could operate on reserves of furnace oil are also available, but presently cost considerably more. The use of either type of unit is likely to involve an overall investment of $1000.00 or more and is, therefore, out of the question for the family of average means, though it may be noted that such units would be most useful in any emergency involving loss of electric power.

Attention was directed first in Canada to the basement family fallout type of shelter. Plans for a recommended standard shelter were prepared and the construction of such units was recommended by the Government of Canada to the public. Earlier proposals for such shelters had not envisaged the need for heating, and in general suggested that lighting be provided from flashlights or other dry battery devices. The need for cooking had not been considered and no guidance was given about this. There was usually a warning against the use of open-flame appliances.

The Canadian shelter committee which was charged with the preparation of plans and instructions decided that some form of heating within the shelter was desirable, if not necessary, for some parts of Canada, and recommended that kerosene be stored in amounts up to 10 gallons for use as an emergency fuel for cooking, heating and lighting. It was decided to accept as a calculated risk the operation of small open-flame kerosene appliances within the shelter, at least until further studies could be carried out to evaluate the problems involved.

The Division of Building Research, National Research Council, which was represented on the shelter committee undertook to carry out studies of the need for heating, the associated problems of ventilation, and the selection and operation of appliances. A standard shelter was constructed in a house made available for the purpose by the Emergency Measures Organization. This has now been operated over two summer and three winter periods. Additional laboratory studies have been carried out on fuel-burning lamps and stoves and their operation within a shelter space.

General Shelter Performance

The fallout shelter constructed for study was of the size recommended for five persons, and had a volume of 400 cu. ft. The house in which it was located was single storey and was considered to be typical of contemporary single-family dwellings. The basement volume was about 6,000 cu. ft.

The ventilation openings provided were as recommended, formed by two blocks at the top and two at the bottom set on their sides so that the cores provided about 80 sq. in. of ventilation opening at each location, with a vertical separation of 4 ft. 8 in. Measurements were made of temperatures and ventilation rates with simulated occupancy, without and with heating under winter conditions. The heat of five occupants was found to be sufficient to raise the temperature about 15°F above basement temperature, while the addition of about 5,000 BTU of supplementary heat per hour from a heater raised the temperature by another 15°F. The ventilation rates were 25 cfm and 55 cfm respectively, (5 cfm and 11 cfm per person) increasing as the shelter-to-basement temperature difference was increased. This characteristic of a simple fixed gravity ventilation arrangement is worthy of special note. If fuel is burned within the shelter at higher rates, leading to higher temperatures, the ventilation rate increases thus automatically providing greater capacity for the removal of the increased volume of products of combustion.

Increase of relative humidity was not found to be a problem during winter trials. As should have been anticipated, the colder surfaces of the shelter at outside basement walls above grade served as a condensing surface for removal of excess moisture.

Shelter operation during summer trials did not reveal any special problems. In summer the door to the shelter from the basement can be left open thus increasing the ventilation rate greatly to assist in reducing the rise in shelter temperature above basement temperature. The addition of heat from cooking and lighting can be minimized by operating appliances under the hood provided so that hot gases are discharged directly to the basement. There is a possibility that shelter temperatures may reach or even exceed slightly the limiting condition of 85°F effective temperature. This will only occur during short periods of extreme high temperature. It is difficult to find any way to offset this condition except to take advantage of the slightly cooler conditions which will exist near floor level as a result of the cool basement floor and entering air.

Basement Ventilation

It was not expected that basement ventilation would be critical, in view of the much larger volume involved, though this might have been anticipated. Basement ventilation rates were found to be as low as $\frac{1}{4}$ air changes per hour in winter and $\frac{1}{10}$ air changes per hour in summer, providing 25 cfm (5 cfm per person) and 10 cfm (2 cfm per person) respectively. This means that the carbon dioxide content of the air drawn from the basement for ventilation of a shelter might already be appreciable, thus leading to still higher concentrations within the shelter because of the sources of carbon dioxide there.

The test basement was considered to be relatively tight against air leakage. Further tests involving opening the door between kitchen and basement and adding intentional openings to simulate leaky basement windows did not provide the expected increase in ventilation rates, mainly because the house above was also relatively tight. There is no doubt that providing substantially increased openings in basement and house will have the result of increasing basement ventilation though problems of reduced basement temperature and estimation of the amount of opening required will then arise.

Ventilation Requirements

Ventilation requirements for normal occupancy are normally set by considerations of odour and in some cases by the need to remove excessive heat or moisture to control temperature and humidity. The ventilation rates established in this way are normally greatly in excess of the rates at which increase of carbon dioxide or depletion of oxygen becomes of concern. High odour levels are not a particular menace to health and it is assumed that where survival is involved they need not be allowed to govern. Increase in carbon dioxide thus becomes the governing factor. The limit set by the American Conference of Government Industrial Hygienists and widely accepted for 8-hour per day occupancy is 5,000 parts per million, or 0.5%. This leads to a minimum ventilation requirement of $2\frac{1}{2}$ cfm of uncontaminated, or diluent air per person, or $12\frac{1}{2}$ cfm for a shelter occupancy of five.

This figure applies to the case of occupants only. If, in addition an unvented fuel-burning appliance is to be used, the ventilation rate must be increased. The release of heat at the rate of 5,000 BTU per hour from a small heater within a shelter will require the burning of $\frac{1}{4}$ lb. ($\frac{1}{4}$ pint) of fuel per hour, and will produce carbon dioxide at the same rate as nine additional people, thus requiring an additional $22\frac{1}{2}$ cfm of air or 35 cfm in all to meet the 0.5% limit of carbon dioxide. The release of heat at the rate of 10,000 BTU per hour, resulting from the burning of fuel at $\frac{1}{2}$ lb. per hour, which is about the maximum capacity for most of the small appliances available, will require 45 cfm or $57\frac{1}{2}$ cfm in all.

Reference now to the performance figures quoted above for the shelter will show that it has sufficient ventilation at all times to limit the increase of carbon dioxide to 0.5%. However, some simple arithmetic applied to the basement ventilation figures will show that in summer with occupants only the basement air

might already contain 0.5% carbon dioxide, and that under extreme conditions in winter with fuel burned at ½ lb. per hour, the basement carbon dioxide level might reach 1%, to be increased to 1.5% in the shelter. These are calculated figures based on measured ventilation rates.

Reappraisal of the carbon dioxide limits for shelters on the basis of recent studies and consideration of submarine experience has led to the acceptance of a figure of 1.5% for normal shelter design, and of 3% which might have to be accepted under severe conditions. On this basis the maximum concentrations anticipated under operating conditions with an unvented fuel-burning appliance operated at rates up to 10,000 BTU per hour in a shelter having the recommended ventilation openings would appear to be acceptable so far as carbon dioxide is concerned.

The ratio of oxygen depletion to carbon dioxide production is about 1.2 on a volume basis for occupants, and is about 1.5 for appliances burning kerosene fuel. A carbon dioxide increase of 3% resulting from operation of a fuel-burning heater will result in an oxygen depletion of 4.5%. This will result in a reduction in oxygen content from the normal 21% to 16½%. A lower limit of 14% is quoted for oxygen content if only survival, and not the performance of essential tasks, is involved.

It is of interest to note the times to reach various carbon dioxide concentrations in a sealed shelter providing 80 cu. ft. per person, with occupants only and no fuel-burning appliances operating. These concentrations increase at the rate of about one percentage point per hour. Thus 3% would be reached in 3 hours, and under extreme emergency conditions a person might survive a concentration of 5%, reached in 5 hours. A 3% concentration of carbon dioxide would be reached in an occupied but sealed shelter with a heater burning ½ lb. per hour of fuel in only 40 minutes. It might be argued that such a situation might be created through ignorance or accident should the shelter ventilation openings become blocked while a heater was in operation. There are, fortuitously several factors which almost completely eliminate any such possibility. First of all, it is extremely difficult to achieve a sealed shelter. Secondly the temperature rise associated with the burning of fuel at such a high rate with little ventilation would provide some warning. Finally, the appliances which appear to be most suittable for general fallout shelter use will not continue to burn at carbon dioxide concentrations above 3%. In fact, the marked reduction in flame size of the ordinary wick-type kerosene lamp will give ample warning of an increase in carbon dioxide with the concomitant decrease in oxygen well before the 3% limit is reached.

Carbon Monoxide Production

Nothing has been said thus far of carbon monoxide. It is not normally present in fresh air and is not produced by the human body. However, it can be and often is produced during the combustion of carbon or hydrocarbon fuels in fuel-burning appliances in amounts which are potentially hazardous. The safe limit is 100 parts per million, or only 2% or 1 part in 50 of the normal limit of 0.5% on carbon dioxide and since the effects of carbon monoxide are cumulative, it poses a very real cause for concern in connection with the operation of unvented fuel-burning appliances in confined spaces. Correspondingly if the acceptable limit of carbon dioxide is 1.5% the corresponding ratio of carbon monoxide production so as not to exceed 100 ppm is 1 part in 150 and for a carbon dioxide limit of 3% the carbon monoxide must not be present in greater amount than 1 part in 300.

Studies now being made on a variety of heaters indicate that they show increased carbon monoxide production in relation to carbon dioxide as the carbon dioxide level is increased. Tentative results show a ratio of about 1 part in 100 for the better heaters, which would indicate that carbon monoxide concentration might exceed 100 ppm when the carbon dioxide concentration exceeds 1%. Further studies are required to explore this matter.

Indications thus far are that the simple-wick type kerosene appliances are among the more satisfactory so far as carbon monoxide production is concerned. In addition they exhibit reduced burning rate as carbon dioxide content increases, which serve also to limit the maximum concentrations of carbon monoxide which can be developed.

Hazards of Some Types of Heaters

Tests on a variety of small fuel-burning appliances have shown thus far that all fuel devices are likely to experience a decrease in burning rate as the carbon dioxide increases and oxygen decreases. In general the more refined combustion systems, particularly those supplied with fuel under pressure and producing non-luminous flames will continue to burn at higher carbon dioxide levels up to as high as 5%.

There is a serious disadvantage to all heaters having either forced or constant flow fuel feed, for shelter use. When, in the event of an increase in carbon dioxide, the burning rate is reduced, the present fuel feed rate may exceed the burning rate, leading to flooding and risk of fuel spillage and fire. Again, on this count, the simple wick-type burner drawing its fuel from a reservoir below by capillarity through the wick would appear to be the least hazardous.

Need for Supplementary Shelter Heat

It is possible to calculate the temperature which will be obtained in a given shelter provided all the per-

TABLE I

Temperatures in Canadian Cities

(Weather data taken from Climatological Atlas of Canada)

Temperature	*Halifax*	*Ottawa*	*Toronto*	*Saskatoon*	*Vancouver*
Mean Annual	+45	+ 42	+ 45	+ 35	+ 50
Mean Jan. Daily	+20	+ 10	+ 20	0	+ 32
Min.	+15	0	+ 12	— 10	+ 30
Max.	+32	+ 20	+ 30	+ 10	+ 40
Mean Annual Min.	—10	— 30	— 10	— 40	+ 10
Extreme Lowest	—20	— 40	— 25	— 60	— 10
Design Temp. 1% Jan.	0	— 15	— 10	— 40	0
5%	+ 5	— 10	+ 2	— 30	+ 15
10%	+10	— 5	+ 10	— 25	+ 20
Mean July Daily	65	67	70	65	62
Min.	55	57	60	52	50
Max.	70	80	80	80	75
Mean Annual Max.	85	90	95	95	87
Extreme Highest	95	102	105	105	100
Design Temp. 1%	80	85	87	90	80
5%	75	82	82	85	75
10%	70	80	81	80	70
Degree Days	7,500	9,000	7,500	11,000	6,000

TABLE II

Estimates of Basement and Shelter Winter Temperatures

Temperature	*Halifax*	*Ottawa*	*Toronto*	*Saskatoon*	*Vancouver*
Est. min. basement temp.	+40	+25	+40	+ 5	+50
Est. min. shelter temp.	+55	+40	+55	+20	+65
Est. shelter temp. heated (5,000 BTU per hour)	+70	+55	+70	+35	+80

tinent conditions including the weather, the construction, and the temperature and thermal properties of the ground adjacent to the basement are known. At best, the calculation is complex. In practice the problem becomes even more difficult not only because of the variations in construction from one house to another but also because of the major influence of the weather both prior to and during any assumed period of emergency. Any prediction must therefore be associated with a probability that it will occur.

Thus far, attempts to estimate basement and shelter temperature have been based largely on consideration of the limited test results available. It is tentatively proposed for purposes of consideration of heating requirements in various regions that the low temperature persisting for 10% of the hours in January be used as a base. These and other indices of weather severity for January and July are given in Table I for five cities representative of five corresponding climatic zones. It is proposed that the representative basement temperature for a typical house with all normal heating cut off as in an emergency be taken as 30 degrees higher than the 10% design temperature in each city. The estimated shelter temperature may be taken as 15 degrees above basement temperature occupied but unheated, and 30 degrees above basement temperature if heated at the rate of about 5,000 BTU per hour, as found in the studies to date. These various estimates are shown in Table II.

On the basis of a minimum acceptable shelter temperature of 50° which has been proposed by others, it may be concluded that Halifax, Toronto and Vancouver and all other locations having similar winter temperatures may not require supplementary shelter heating. However even in these locations the storage of kerosene for lighting and cooking can still be recommended, and may be used as desired for some heating to improve shelter conditions. The same appliance can be used satisfactorily for cooking and for heating. Heating is shown to be necessary for Ottawa and similar locations, and the rate of 5,000 BTU proposed would appear to be adequate. In Saskatoon, however, which may be taken as representative of the Prairie

area including Winnipeg, Regina, Edmonton and Calgary, the heated temperature shown of 35°F is still well below the 50° minimum.

The estimated basement temperature for Ottawa indicates that there is a chance of freezing temperatures during an emergency period in January. This risk might be accepted but should be taken into account in considering the provision of water supplies and of possible damage to undrained piping and fixtures. Basement temperatures in Saskatoon and other Prairie locations will almost certainly fall well below freezing during a January emergency and may even be so low as to result in heaving of foundations in some cases. In view of this and other consideration including the widespread availability of gas, consideration should be given to the possibility of emergency basement heating at rates up to 20,000 BTU per hour. With basement temperatures thus raised above freezing, only moderate heating within the shelter would be required. The feasibility of this is being given further study. ▲

The Truro and Colchester County Civil Defence headquarters in the basement of the Civic Building, was officially opened yesterday.

The headquarters will serve as a center to co-ordinate municipal and county government activities during a national emergency. It is designed to house the elements of governmental administration, plus heads of services including fire, police, health, transportation, welfare, communication, public relations, and other existing services in the community and county.

The centre has fallout protection and facilities to maintain emergency operational control of the area for an indefinite period.

Some of the facilities in the headquarters include sleeping accommodation, emergency lighting, heating and ventilations, toilet facilities, food and necessary equipment storage, and a communication control.

The operations of the civil defence for Truro and Colchester County are presently administered from this centre.

From the Chronicle-Herald, Halifax, N.S.

Statement Made in the House of Commons by the Acting Prime Minister, the HONOURABLE LIONEL CHEVRIER, on Tuesday, July 2, 1963.

(*Hansard, p. 1723, Tuesday, July 2, 1963*)

As they will affect the handling of questions in the house, may I take this opportunity to inform hon. members of certain administrative changes, effective as of July 1, with respect to civil emergency planning.

This programme, as members will recall, is carried on at the federal level by various departments and agencies of the government and has been co-ordinated by the emergency measures organization in the privy council office. An order in council, P.C. 1959–656, is the basis of the arrangement in effect up to this time, with the Prime Minister and the ministers of national defence, national health and welfare and justice being those specifically allocated various responsibilities by the order.

The government has decided to consolidate arrangements and to bring about a closer degree of co-ordination among the emergency measures organization, the civil defence college and the emergency supplies planning branch in the Department of Defence Production. Pursuant to the Public Service Rearrangement and Transfer of Duties Act, order in council P.C. 1963–993, a copy of which I am now tabling, transfers the responsibility for the emergency measures organization from the Prime Minister to the Minister of Defence Production. The order also transfers responsibility for the civil defence college from the Minister of National Health and Welfare to the Minister of Defence Production, to be exercised through the emergency measures organization. The director of the emergency measures organization will report direct to the Minister of Defence Production.

CANADA

PRIVY COUNCIL

AT THE GOVERNMENT HOUSE AT OTTAWA

THURSDAY, the 27th day of JUNE, 1963

PRESENT:

HIS EXCELLENCY

THE GOVERNOR GENERAL IN COUNCIL:

His Excellency the Governor General in Council, on the recommendation of the Right Honourable L. B. Pearson, the Prime Minister, is pleased hereby to make the following order, effective July 1st, 1963:

1. Pursuant to Section 2(*a*) of the Public Service Re-arrangement and Transfer of Duties Act,—

   (*a*) the powers, duties and functions of the Prime Minister relating to civil defence, and the control and supervision of the Emergency Measures Organization are transferred to the Minister of Defence Production and para. 6 of the Civil Defence Order, 1959 (P.C. 656 of May 28th, 1959) is amended by the substitution of "The Minister of Defence Production" for "The Prime Minister";

   (*b*) the powers, duties and functions of the Minister of National Health and Welfare relating to the Civil Defence School at Arnprior, Ontario, and the control and supervision of the Civil Defence School, are transferred to the Minister of Defence Production to be exercised through the Emergency Measures Organization, and the Civil Defence Order, 1959 (P.C. 656 of May 28th, 1959) is amended by the deletion of para. 4(*b*), and the addition to para. 6 of the following:

   (*e*) direction and administration of the Civil Defence College at Arnprior, Ontario.

2. Pursuant to Section 2(1)(*g*) of the Civil Service Act, and Section 2(*f*)(ii) of the Financial Administration Act, the Emergency Measures Organization is designated a "Department" for the purposes of those Acts.

3. Pursuant to Section 2(1)(*h*) of the Civil Service Act, the Director of the Emergency Measures Organization is designated the Deputy Head of the department for the purposes of the Civil Service Act and to act as deputy for the Minister responsible.

4. Pursuant to Section 2(*a*)(ii) of the Financial Administration Act, the Minister of Defence Production is the appropriate Minister with respect to the Emergency Measures Organization for the purposes of that Act.

5. Where in the Public Service Superannuation Regulations a responsibility is placed on a deputy head, that responsibility shall, in relation to the Emergency Measures Organization, be exercised by the Director.

6. Para. 8 of the Civil Defence Order, 1959 (P.C. 656 of May 28th, 1959) is revoked.

If undelivered return to:
EMERGENCY MEASURES ORGANIZATION
Office 420, Daly Building,
Ottawa, Canada

OFFICIAL POSTAL FRANK

R. B. Bryce

PRIVY COUNCIL OFFICE